Claims

I claim:

1. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston;

the piston having an outer surface having an elliptical cross-section; and

the flexible sleeve forming a rolling lobe cooperatively engaged with the outer surface.

2. The air spring as in claim 1, wherein the end member is tilted with respect to a piston major axis.

3. The air spring as in claim 1 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

4. The air spring as in claim 1, wherein a major axis of a flexible sleeve elliptical stress distribution is disposed at approximately 90° to a major axis of the outer surface elliptical cross-section.

5. The air spring as in claim 4, wherein the flexible sleeve is engaged with the piston outer surface such that the flexible sleeve comprises a substantially circular stress distribution.

6. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston;

the piston having an outer surface having an elliptical cross-section;

the flexible sleeve forming a rolling lobe cooperatively engaged with the outer surface; and

a major axis of a sleeve elliptical stress distribution is disposed at approximately 90° to a major axis of the outer surface elliptical cross-section.

7. The air spring as in claim 6, wherein the end member is tilted with respect to a piston major axis.

8. The air spring as in claim 6 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

9. The air spring as in claim 6, wherein the flexible sleeve is engaged with the piston outer surface such that the rolling lobe comprises a substantially circular stress distribution.

10. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston, the end attached to the piston describing a rolling lobe;

the piston having an outer surface having an elliptical cross-section; and

the rolling lobe cooperatively engaged with the outer surface; and

the flexible sleeve comprises a substantially circular stress distribution.

11. The air spring as in claim 10, wherein the end member is tilted with respect to a piston major axis.

12. The air spring as in claim 10 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

13. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston;

the piston having an outer surface having an elliptical cross-section; and

a major axis of a sleeve elliptical stress distribution is disposed at approximately 90° to a major axis of the outer surface elliptical cross-section.

14. The air spring as in claim 13, wherein the end member is tilted with respect to a piston major axis.

15. The air spring as in claim 13 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

16. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston;

the piston having an outer surface having an elliptical cross-section; and

the flexible sleeve is engaged with the piston outer surface such that the flexible sleeve comprises a substantially uniform stress distribution.

17. The air spring as in claim 16, wherein the end member is tilted with respect to a piston major axis.

18. The air spring as in claim 16 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

19. The air spring as in claim 16, wherein a major axis of a flexible sleeve elliptical stress distribution is disposed at approximately 90° to a major axis of the outer surface elliptical cross-section.

20. An air spring comprising:

a flexible sleeve having one end attached to an end member and the other end attached to a piston; and

the piston having an outer surface having an elliptical cross-section.

21. The air spring as in claim 20, wherein the end member is tilted with respect to a piston major axis.

22. The air spring as in claim 20 wherein the outer surface has a ratio in the range of approximately 1.0 to 1.5.

23. The air spring as in claim 20, wherein a major axis of a flexible sleeve elliptical stress distribution is disposed at approximately 90° to a major axis of the outer surface elliptical cross-section.

24. The air spring as in claim 20, wherein the flexible sleeve is engaged with the piston outer surface such that the flexible sleeve comprises a substantially circular stress distribution.